

15. Vehicles by age

Overview

Target

This view is completely focused on vehicles. Its primary aims are the evaluation new vehicle registrations on the basis of projections on the evolution of the vehicle stock. The view also takes care of updating the information on aging and scrappage of existing vehicles.

Structure

The general appearance of the view is shown in Figure 15.1.

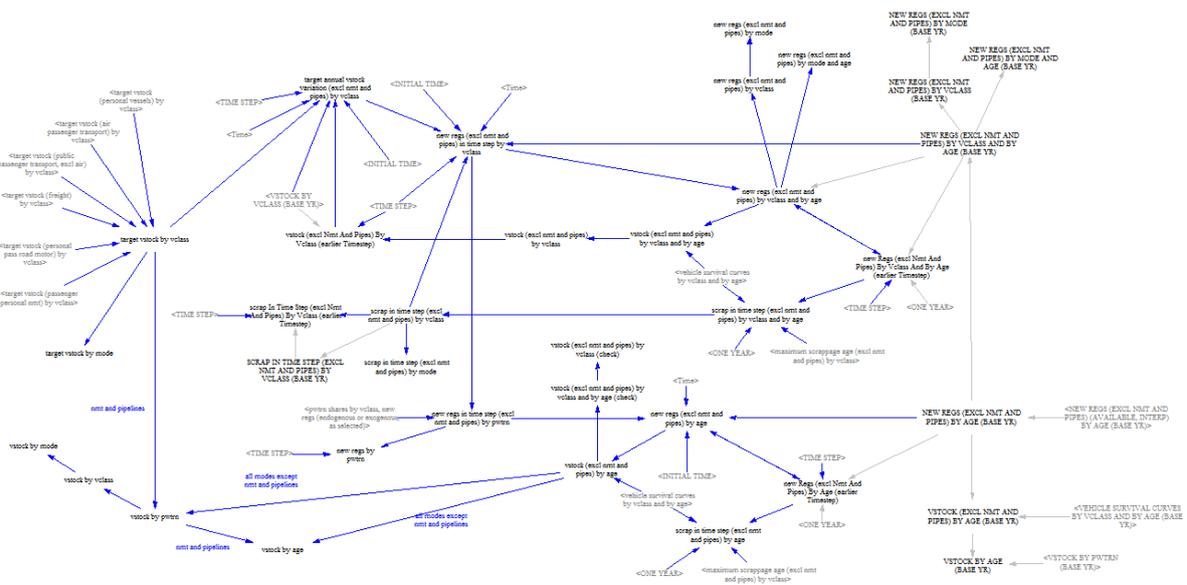
Information on the evolution of the vehicle stock for all transport modes (both for passenger and freight services), coming from the "demand" views, enters this view on the top left area.

Two ageing loops, one focused on the vehicle class level and another on the powertrain level, are respectively located in the centre right and bottom right areas of the view. These loops require inputs on scrappage (or survival) profiles over time.

Information on historical data on new vehicle registrations, necessary for the ageing and scrappage calculations, enter the view on the right side.

Information on the powertrain selection by technology is required to perform the calculations included in the ageing loop at the powertrain level.

Figure 15.1 Vehicles by age view: general appearance of the Vensim sketch

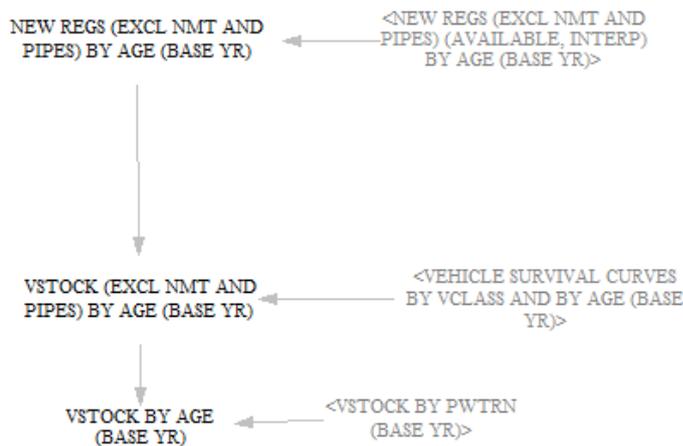


Detailed description of the view

Inputs

Inputs concerning the historical new vehicle registration by age at the base year enter the view on the bottom right (Figure 15.2).

Figure 15.2 Inputs concerning the historical new vehicle registration by age in the Vensim sketch

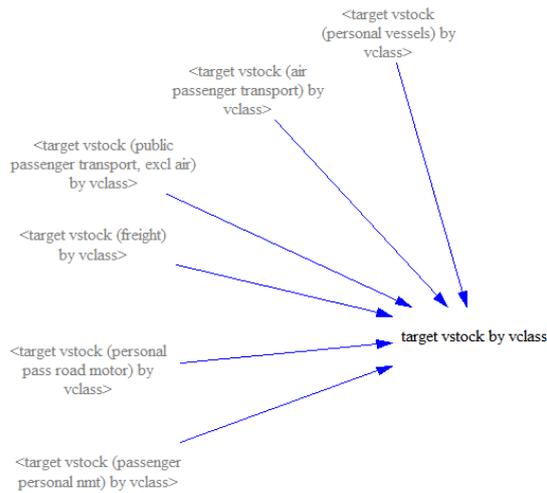


In concordance with the explanation of the view "vehicles, new registrations (historical)", the vehicle historical sales are available from the user within the ten years prior to the base year and are estimated to be constant in earlier years. When the maximum scrappage age is more than the available subscripsts for age in the model (XXV), the value given to the sales at the last age subscrip covers the whole period between the highest available subscrip and the maximum scrappage age (as explained in the view "vehicles, new registrations (historical)"). The variable "NEW REGS (EXCL NMT AND PIPES) BY AGE (BASE YR)" contains the historical sales of vehicles by powertrain in the corresponding age subscrip. Applying the vehicle survival curves to the historical sales gives the number of vehicles in the vehicle stock, by age. In this way the vehicle stock, characterized by powertrain, contains information on the vehicles (by age of registration) that are estimated to be still circulation at the base year.

Summing up the values along the different powertrains in the variable "NEW REGS (EXCL NMT AND PIPES) BY AGE (BASE YR)" provides the aggregated value by vehicle class. This is necessary for the determination of the vehicle-related information on the centre-right of the view (containing calculations by vehicles class rather than by powertrain).

Endogenous inputs coming from the demand generation module, and enabling to use the variable "target vehicle stock "as the main driver of the information contained in this view, are on the top left of the view (Figure 15.3).

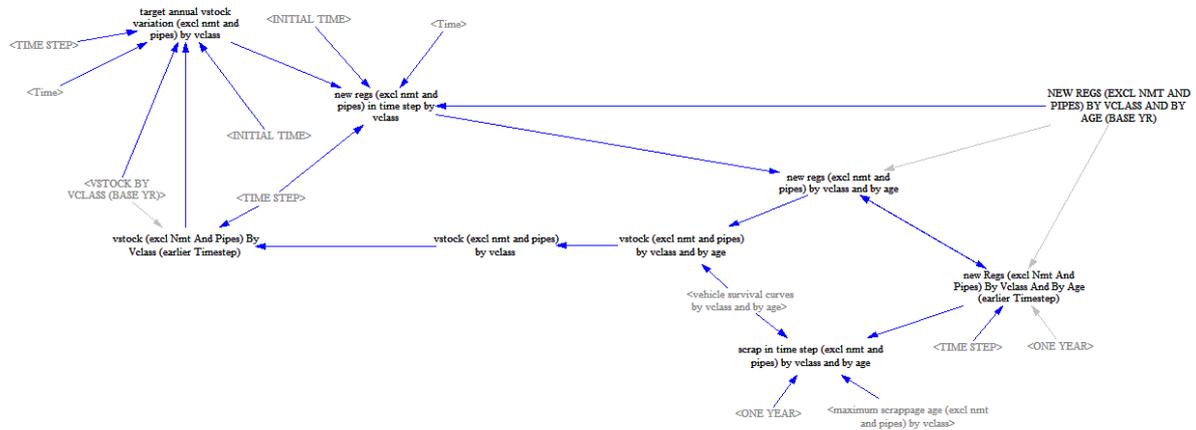
Figure 15.3 Inputs from the demand generation module: Vensim sketch



Calculations and outputs

Considering the historical sales by vehicle class and the target vehicle stock by vehicle class, the loop on the centre-right of the view it determines the new registrations, aging and scrappage of the vehicles by class (Figure 15.4).

Figure 15.4 New registrations, aging and scrappage of the vehicles by class: Vensim sketch

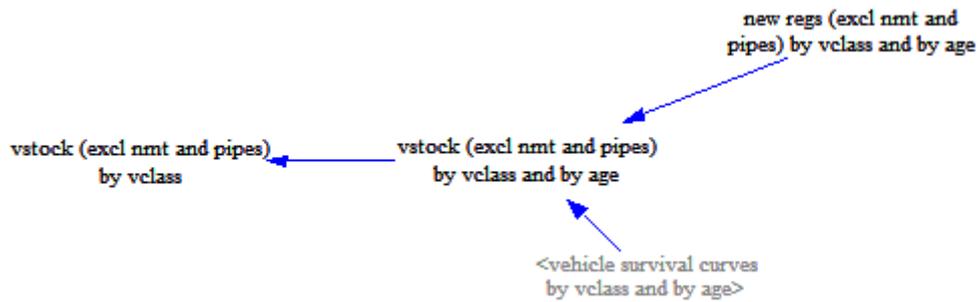


In particular, the variable "NEW REGS (EXCL NMT AND PIPES) BY VCLASS AND BY AGE", initialized with the historical vehicle sales, is updated over time with new vehicle registrations resulting from the evolution of the drivers affecting the total vehicle stock and includes the replacement of old vehicles that are being scrapped. Apart from including the number of new vehicle registrations by vehicle class, the variable "NEW REGS (EXCL NMT AND PIPES) BY VCLASS AND BY AGE" is also ageing them over time via the application of survival curves:

$$\text{Vehicle stock by age} = \text{New vehicle registrations by age} \times \text{Survival rate by age}$$

The aggregated value of the vehicle stock by vehicle class is obtained summing up the vehicles still existing in different age cohorts (Figure 15.5).

Figure 15.5 Vehicle stock by vehicle class from vehicles still existing in different age cohorts: Vensim sketch



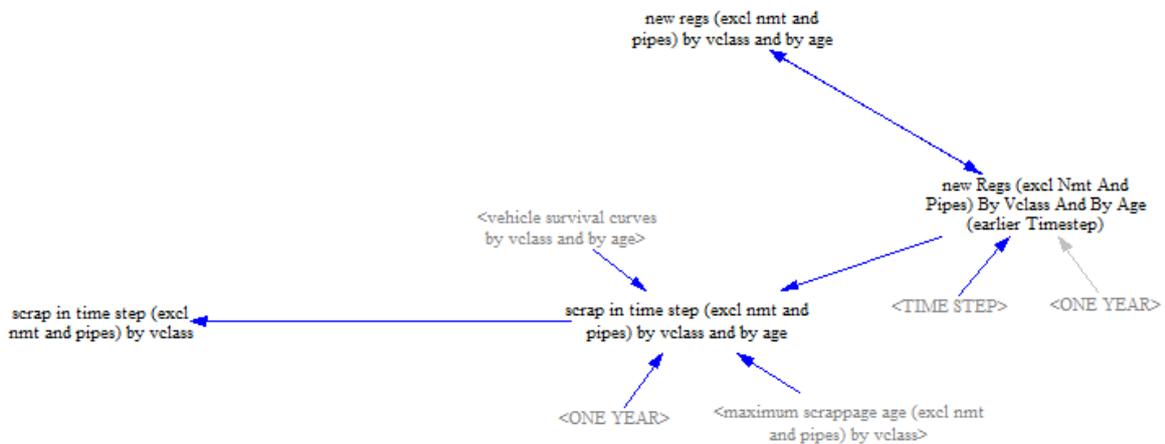
The vehicles scrapped in each time step by age are calculated by means of affecting the new vehicle registrations (*NR*) at the earlier time step by the following difference of survival rate (*SR*) curves:

$$\text{Scrappage between } TIME - TIME STEP \text{ and } TIME = NR \text{ by age at } TIME - TIME STEP \times ((1 - SR \text{ by age}) - (1 - SR \text{ at the previous age}))$$

Using the difference between survival curves delayed by a time step allows considering the scrappage by age in a single time step.

The aggregated value of the scrapped vehicles (by vehicle class) in a time step is obtained summing up the scrapped vehicles in different age cohorts (Figure 15.6).

Figure 15.6 Vehicle scrappage: Vensim sketch



The new vehicle registrations in a time step are calculated on the basis of the target vehicle stock (*TVS at TIME*) coming from the demand generation module, the scrapped vehicles in a time step (*SC between TIME - TIME STEP and TIME*), and the vehicle stock before this scrappage step (*VS at earlier TIME STEP*):

$$\text{New vehicle registrations at } TIME = TVS \text{ at } TIME - VS \text{ at earlier } TIME STEP + SC \text{ between } TIME - TIME STEP \text{ and } TIME$$

The corresponding Vensim calculations are reproduced in.

Figure 15.7 New vehicle registrations in a time step: Vensim sketch

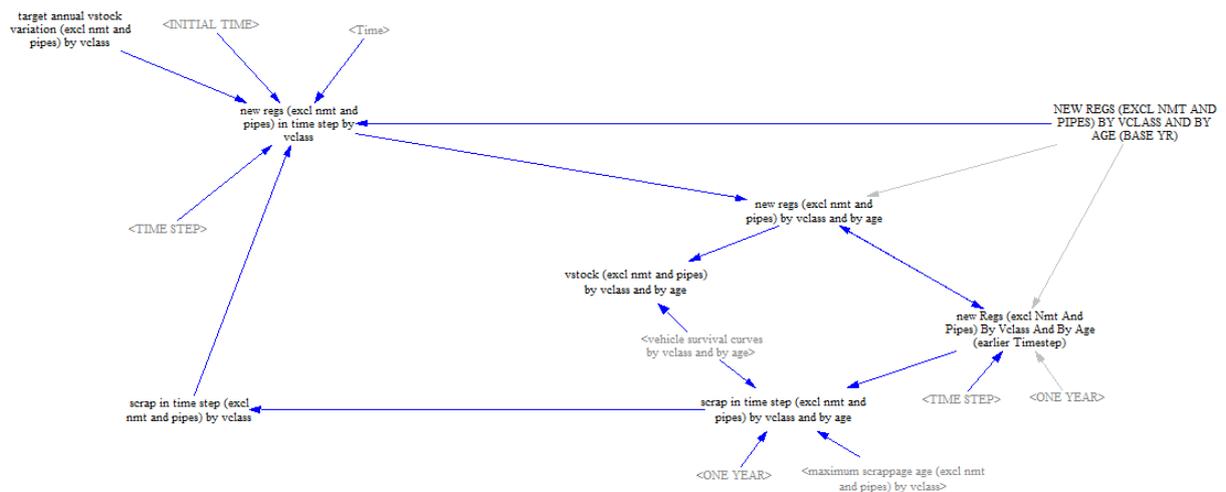
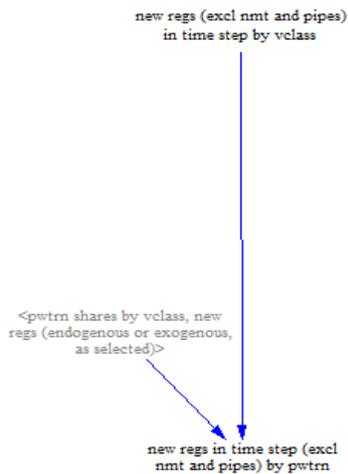


Figure 15.8 New vehicle registrations by powertrain: Vensim sketch

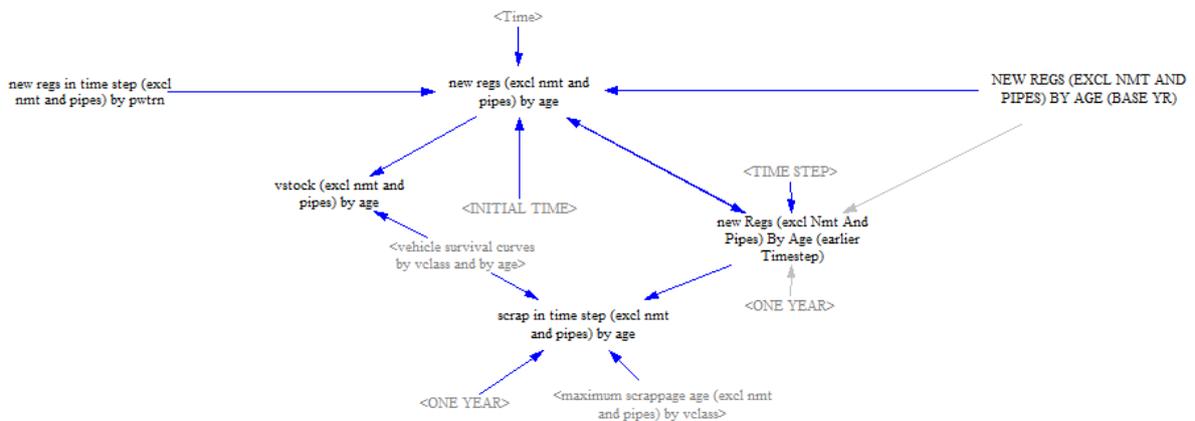


The calculated new vehicle registrations over time by vehicle class are disaggregated by powertrain by means of the powertrain shares (either introduced directly by the user as exogenous inputs or calculated endogenously by means of the logit model explained in the "vehicles, powertrain choice (logit)" view) (Figure 15.8).

The new vehicle registrations over time by powertrain and the historical sales by powertrain allow to perform a loop of calculations similar to the one described for each vehicle class (Figure 15.4), but at the powertrain level of disaggregation (Figure 15.9).

The approach outlined here leads to results at the vehicle class and powertrain disaggregation levels that are fully coherent.

Figure 15.9 New registrations, aging and scrappage of the vehicles by powertrain: Vensim sketch



In case of non-motorised transport and pipelines modes the vehicle stock by powertrain corresponds directly to the target vehicle stock by vehicle class. The only powertrain technology concerned are

NO POWERTRAIN in case of non-motorised transport and PIPELINE PUMP in case of pipelines. In addition, non-motorised transport and pipelines modes are not considered in the aging calculation of the vehicle stock. The stock value is therefore allocated to the age subscript ZERO in vehicle stock variables expressed by age. In this last case, other subscripts remain always initialized to zero.

Once the non-motorised transport and pipelines modes have been included, the vehicle stock by powertrain, by vehicle class, and by mode, are obtained by means of summing up accros the corresponding subscripts (Figure 15.10).

Figure 15.10 Vehicle stock aggregates calculation: Vensim sketch

